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TITLE: ORGANIC ELECTROLUMINESCENT(EL)
ELEMENT
PUBN-DATE: September 25, 1998

INVENTOR-INFORMATION:

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INT-CL (IPC): H05B033/22, H05B033/14 , H05B033/26

ABSTRACT:

PROBLEM TO BE SOLVED: To provide an organic electroluminescent(EL) element of both polarity capable of emitting light in a simple constitution.

SOLUTION: A transparent electrode 12 comprising transparent electrode material such as ITO and having a large work function, a light emitting layer of organic electroluminescent(EL) material including hole transport material and electron transport material laminated on the transparent electrode 12, and a backing electrode 16 comprising electrode material of a large work function such as Au or Al laminated on the light emitting layer 14 of the organic electroluminescent(EL) material are formed on a transparent substrate 10 of glass or the like. An electron injection layer 20 comprising metal of Li or Mg

having a small work function is roughly equally and partially formed in islands, holes, stripes, or meshes on each lamination part of the light emitting layer 14 of the organic electroluminescent (EL) material with the transparent electrode 12 and the backing electrode 16 at a thickness of about 1 - several tens of Å.

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DERWENT-WEEK: 199850

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TITLE: Organic EL element for plane light
source or display device - has electron injection layer
formed on lamination portion of light emission
layer, transparent electrode and back plate

PRIORITY-DATA: 1997JP-0069076 (March 6, 1997)

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ABSTRACTED-PUB-NO: JP 10255982A

BASIC-ABSTRACT:

The EL element has a transparent electrode (12) formed on a transparent substrate (10). A light emission layer (14) laminated on the transparent electrode, includes hole and electronic transportation materials.

A back plate (16) consisting of Au and Al electrode material is formed on the surface of light emission layer. An electron injection layer (20) made of metals like Li, Mg in the thickness of 1-10 Angstrom is

formed on each
lamination portion of light emission layer, transparent
electrode and back
plate.

ADVANTAGE - Provides light emission with different
polarities of electrode.
Simplifies handling.

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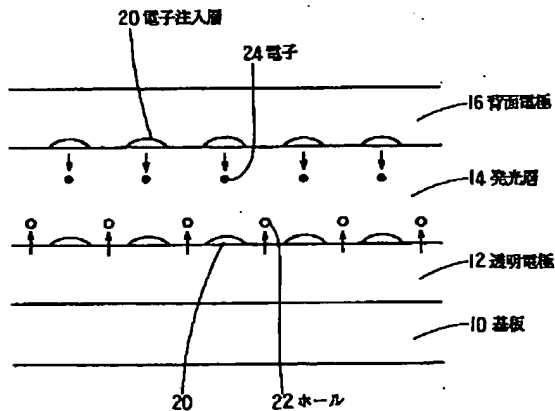
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(54) 【発明の名称】 有機EL素子

(57) 【要約】

【課題】 簡単な構成で、両極性で発光可能な有機EL素子を提供する。

【解決手段】 ガラス等の透明基板10上にITO等の透明な電極材料であり仕事関数の大きい透明電極12と、この透明電極12に積層されホール輸送材料及び電子輸送材料を含む有機EL材料の発光層14と、この有機EL材料の発光層14に積層されAuやAl等の仕事関数の大きい電極材料による背面電極16を形成する。有機EL材料の発光層14と透明電極12及び背面電極16との各積層部分に、1~数十Å程度の厚さに仕事関数の小さいLiやMg等の金属からなる電子注入層20を、島状、穴あき状、ストライプ状、または網目状等のほぼ均等に部分的に形成する。



【特許請求の範囲】

【請求項1】 透明基板上に透明な電極材料であり仕事関数の大きい透明電極と、この透明電極に積層されホール輸送材料及び電子輸送材料を含む有機EL材料の発光層と、この発光層に積層され仕事関数の大きい電極材料による背面電極を形成し、上記有機EL材料の発光層と透明電極及び背面電極との各積層間に、仕事関数の小さい金属からなる電子注入層を、ホールの通過が可能な状態に形成した有機EL素子。

【請求項2】 上記電子注入層は、上記各電極と上記発光層との間に島状、穴あき状、ストライプ状または網目状に形成されている請求項1記載の有機EL素子。

【請求項3】 上記有機EL材料の発光層は、積層構造に形成され、中央にホールブロック層を形成し、その両側に各々異なる発光材料を含有した発光層を形成した請求項1または2記載の有機EL素子。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、平面光源やディスプレイに用いられる有機EL素子に関する。

【0002】

【従来の技術】従来、例えば有機EL（エレクトロルミネッセンス）素子は、ガラス基板上に透光性のITO膜の陽極を形成し、その上面に有機EL材料であるトリフェニルアミン誘導体（TPD）等のホール輸送材料及びアルミキレート錯体（Alq₃）等の電子輸送性発光材料等を積層している。そしてその上面に、Al、Li、Ag、Mg、In等の陰極を形成している。この有機EL素子は、ITO膜の陽極とAl-Mg等の背面電極である陰極間に所定の電圧が印加され、発光を生じるものである。

【0003】

【発明が解決しようとする課題】ここで、ELは、仕事関数の大きいITOから発光層へホールの注入がなされ、仕事関数の小さい陰極からは、電子が供給されることにより発光するものである。従って、このITOと背面電極の極性を逆にして逆バイアスをかけると、上記ホールと電子の注入が起こりにくく、発光が見られない。また、電子輸送材料とホール輸送材料を順次積層した構造の場合、逆バイアスであれば、ホールと電子が僅かに注入されたとしても発光はしない。従って、一つの有機EL素子において、両極性でEL発光可能な素子は従来なかった。

【0004】この発明は、上記従来の技術に鑑みてなされたもので、簡単な構成で、両極性で発光可能な有機EL素子を提供することを目的とする。

【0005】

【課題を解決するための手段】この発明は、ガラス等の透明基板上にITO等の透明な電極材料であり仕事関数の大きい透明電極と、この透明電極に積層されホール輸

送材料及び電子輸送材料を含む有機EL材料の発光層と、この有機EL材料の発光層に積層されAuやAl等の仕事関数の大きい電極材料による背面電極を形成し、上記有機EL材料の発光層と透明電極及び背面電極との各積層部分に、1～数十Å程度の厚さに仕事関数の小さいLiやMg等の金属からなる電子注入層を、島状、穴あき状、ストライプ状、または網目状等のほぼ均等に部分的に形成した有機EL素子である。

【0006】また、上記有機EL材料の発光層を積層構造として、中央にホールブロック層を形成し、その両側に、各々異なる発光材料を含有した発光層を形成した有機EL素子である。

【0007】この発明の有機EL素子は、透明電極側を陽極、背面電極側を陰極とした順バイアス電位を印加した場合は、仕事関数の高いITO等の透明電極から有機EL材料の発光層へホールの注入が行なわれるとともに、陰極である背面電極側では仕事関数の低いLi等の電子注入層から電子の注入が行なわれる。また、逆に透明電極側を陰極、背面電極側を陽極とした逆バイアス電位を印加した場合、仕事関数の高いAu等の背面電極から有機EL材料の発光層へホールの注入が行なわれるとともに、陰極となる透明電極側では仕事関数の低いLi等の電子注入層から電子の注入が行なわれる。

【0008】また、誘起材料の発光層を各々異なる発光材料を含有した発光層を形成したことにより、透明電極と背面電極の電位が順バイアス時と逆バイアス時とで、中央のホールブロック層により隣接層へホールの注入が阻止され、異なる発光を可能にするものである。

【0009】

【発明の実施の形態】以下、この発明の実施の形態について図面を基にして説明する。図1、図2はこの発明の有機EL素子の第一実施形態を示すもので、この実施形態の有機EL素子は、図示するように、ガラス、透明樹脂、石英等の透明基板10の表面に、ITO等の仕事関数の大きい透明な金属材料からなる透明電極12が1μm程度の厚さに形成されている。透明電極12の表面には、有機EL材料による発光層14が数百Å程度の厚さに形成されている。そして、発光層14の表面には、AuやAl等の仕事関数の大きい金属からなる背面電極16が1000Å程度の厚さに形成されている。

【0010】透明電極12と発光層14との間及び背面電極16と発光層14の間には、各々所定の間隔で均等に島状または穴あき状の電子注入層20が数Å程度の極薄い層に形成されている。電子注入層20はLiやMg等の仕事関数の小さい金属により形成されている。またこの電子注入層20はストライプ状や網目状に形成しても良く、その厚さは電子注入が可能な厚さであれば良く、1～数十Å程度の厚さで適宜設定可能である。

【0011】有機EL材料の発光層14は、ホール輸送材料と電子輸送材料が混合された混合材料からなる。発

光層14の母体材料のうちホール輸送材料としては、トリフェニルアミン誘導体(TPD)、ヒドラゾン誘導体、アリールアミン誘導体等がある。また、電子輸送材料としては、緑色発光材料であるアルミキレート錯体(Alq_3)、青色発光材料であるジスチリルピフェニル誘導体(DPVBi)、その他オキサジアゾール誘導体、ビスチリルアントラセン誘導体、ベンゾオキサゾールチオフェン誘導体、ペリレン類、チアゾール類等を用いる。さらに長波長発光色変調するためのドーパントとして、ジシアノメチレン誘導体(DCM)や、ナイルレッド(Nile Red)、緑色の発光材料としてクマリン540(C540)等を適宜添加し、任意の発光色を得る。またホール輸送材料と電子輸送材料の混合比は、10:90乃至90:10の範囲で適宜変更可能である。

【0012】この実施形態の有機薄膜EL素子の製造方法は、先ず基板10上に一面にITO等による透明電極12を通常の真空蒸着やフラッシュ蒸着、スパッタリングその他の真空中の薄膜形成技術により形成する。次に、LiやMg等の電子注入層20を、上記真空薄膜形成技術の任意の方法で、マスキングにより島状、穴あき状、ストライプ状、または網目状等に形成する。次に透明電極12及び電子注入層20の表面に、有機EL材料の発光層14を上記真空薄膜形成技術の任意の方法により形成する。さらに、有機EL材料の発光層14の表面に、LiやMg等の電子注入層20を、上記真空薄膜形成技術の任意の方法で、上記と同様にマスキングにより島状、穴あき状、ストライプ状、または網目状等に形成する。そして、その表面に、上記真空薄膜形成技術のうちの任意の方法により、AuやAl等による背面電極16を形成する。

【0013】次に、背面電極16の表面には、図示しない保護層を適宜形成する。保護層は、AlやAg、さらに樹脂等により背面電極を被覆するものである。

【0014】ここで蒸着条件は、例えば、真空度が 6×10^{-6} Torrで、有機EL材料の場合 $50 \text{ \AA} / \text{sec}$ の蒸着速度で成膜する。フラッシュ蒸着法は、予め所定の比率で混合した有機EL材料を、 $300 \sim 600^\circ\text{C}$ 好ましくは、 $400 \sim 500^\circ\text{C}$ に加熱した蒸着源に落下させ、有機EL材料を一気に蒸発させるものである。また、その有機EL材料を容器中に収容し、急速にその容器を加熱し、一気に蒸着させるものでも良い。

【0015】この実施形態の有機EL素子は、透明電極12側を陽極、背面電極16側を陰極とした順バイアス電位を印加した場合、図1に示すように、仕事関数の高いITO等の透明電極12から有機EL材料の発光層14へホール22の注入が行なわれるとともに、陰極である背面電極16側では仕事関数の低いLi、Mg等の電子注入層20から電子24の注入が行なわれる。そして、発光層14中のホール輸送材料及び電子輸送材料及

びその他の発光材料によりEL発光が生じる。また逆に、透明電極12側を陰極、背面電極16側を陽極とした逆バイアス電位を印加した場合、図2に示すように、仕事関数の高いAuやAl等の背面電極16から有機EL材料の発光層14へホール22の注入が行なわれるとともに、陰極となる透明電極12側では仕事関数の低いLiやMg等の電子注入層20から電子24の注入が行なわれる。

【0016】この実施形態の有機EL素子によれば、透明電極12と背面電極16に印加する電位の極性が何れであっても有効に発光可能なものであり、電極の極性を問わない有機EL素子を能にするものである。

【0017】次にこの発明の有機EL素子の第二実施形態について図3を基にして説明する。ここで上記実施形態と同様の部材は同一の符号を付して説明を省略する。この実施形態の有機EL素子は、発光層14を積層構造としたもので、発光層14の中央にオキサジアゾール誘導体(tBu-PBD)や、フェナンロトロリン誘導体(バソクプロイン)等のホールブロック層26を形成し、その一方の側の透明電極12側には、TPD、 Alq_3 とDCMの混合層28を形成し、他方の背面電極側には、TPD、 Alq_3 とC540の混合層29を形成する。

【0018】この発光層14では、透明電極12が陽極で背面電極16が陰極の順バイアス時は、透明電極12から注入されたホール22が、混合層28とホールブロック層26の界面で浸入が阻止され、混合層28でそのDCMによりオレンジ色の発光が得られる。また、透明電極12が陰極で背面電極16が陽極の逆バイアス時は、背面電極16から注入されたホール22が混合層29とホールブロック層26の界面で浸入が阻止され、混合層29のC540から緑色の発光が得られる。

【0019】この実施形態の有機EL素子によれば、単一の素子で異なる発光が得られるものであり、有機EL素子の小型化やカラーディスプレイとしての用途を開くものである。

【0020】なお、この発明の有機EL素子は、仕事関数の高い電極間に有機EL材料の発光層を形成し、その電極表面に仕事関数の小さい金属の薄い電子注入層を部分的に形成したものであれば良く、その金属の厚さや材料や形状、形成方法は問わない。

【0021】

【発明の効果】この発明の有機EL素子は、透明電極と背面電極の極性を問わずに使用可能であり、有機EL素子の用途を広げるものであり、取り扱いも容易なものとなる。また、電極の極性を変えることにより異なる発光を得ることもでき、一つの素子で複数の機能を発揮することができるものである。

【図面の簡単な説明】

【図1】この発明の第一実施形態のEL素子の順バイア

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ス時の状態を示す模式的断面図である。

【図2】この発明の第一実施形態のEL素子の逆バイアス時の状態を示す模式的断面図である。

【図3】この発明の第二実施形態のEL素子を示す断面図である。

【符号の説明】

10 基板

12 透明電極

14 発光層

16 背面電極

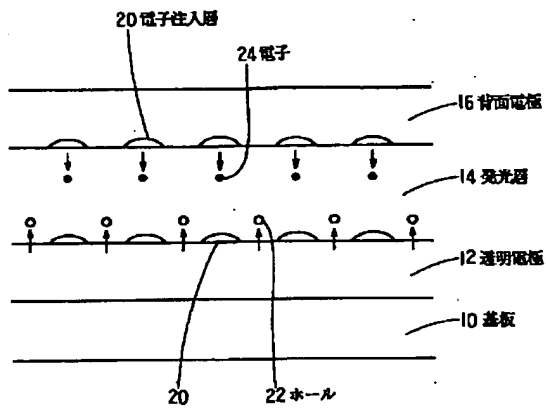
20 電子注入層

22 ホール

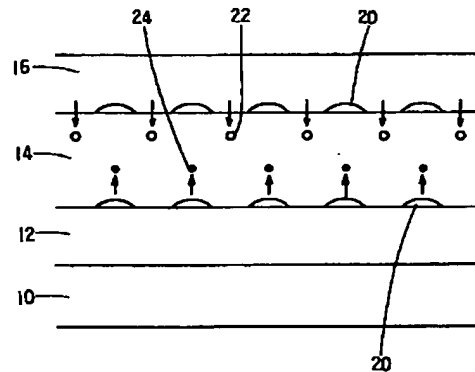
24 電子

6

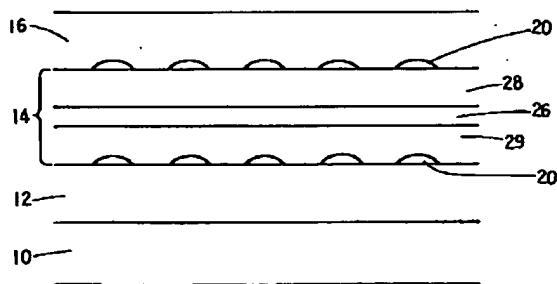
【図1】



【図2】



【図3】



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CLAIMS

[Claim(s)]

[Claim 1] The organic EL device which the laminating was carried out to the luminous layer of the organic-electroluminescence ingredient which is an electrode material transparent on a transparence substrate, and a laminating is carried out to the large transparent electrode of a work function, and this transparent electrode, and contains a hole transportation ingredient and an electronic transportation ingredient, and this luminous layer, formed the back plate by the large electrode material of a work function, and formed the electron injection layer which consists of a small metal of a work function between each laminating with the luminous layer of the above-mentioned organic-electroluminescence ingredient, a transparent electrode, and a back plate in the condition which can pass through a hole.

[Claim 2] The above-mentioned electron injection layer is an organic EL device according to claim 1 currently formed between each above-mentioned electrode and the above-mentioned luminous layer the shape of the shape of an island, and a hole vacancy, the shape of a stripe, and in the shape of a mesh.

[Claim 3] The luminous layer of the above-mentioned organic electroluminescence ingredient is the organic EL device according to claim 1 or 2 which was formed in the laminated structure, formed the hole block layer in the center, and formed the luminous layer containing luminescent material which is respectively different on the both sides.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the organic EL device used for the flat-surface light source or a display.

[0002]

[Description of the Prior Art] The conventional (electroluminescence), for example, organic electroluminescence, component forms the anode plate of the ITO film of translucency in a glass substrate, and is carrying out the laminating of the electronic transportability luminescent material, such as hole transportation ingredients, such as a triphenylamine derivative (TPD) which is an organic electroluminescence ingredient, and an aluminum chelate complex (Alq3), etc. to the top face. And cathode, such as aluminum, Li, Ag, Mg, and In, is formed in the top face. A predetermined electrical potential difference is impressed between the anode plate of the ITO film, and the cathode which is back plates, such as aluminum-Mg, and this organic EL device produces luminescence.

[0003]

[Problem(s) to be Solved by the Invention] Here, impregnation of a hole is made from ITO with a large work function to a luminous layer, and EL emits light by supplying an electron from the small cathode of a work function. Therefore, if the polarity of this ITO and back plate is made reverse and a reverse bias is applied, impregnation of the above-mentioned hole and an electron cannot take place easily, and luminescence will not be seen. Moreover, if it is a reverse bias in the case of the structure which carried out the laminating of an electronic transportation ingredient and the hole transportation ingredient one by one, luminescence will not be carried out even if a hole and an electron are poured in slightly. Therefore, in one organic EL device, the component in which EL luminescence by amphipathy is possible did not have the former.

[0004] This invention was made in view of the above-mentioned Prior art, is an easy configuration and aims at offering the organic EL device which can emit light by amphipathy.

[0005]

[Means for Solving the Problem] This invention is transparent electrode materials, such as ITO, on transparence substrates, such as glass. The large transparent electrode of a work function, The luminous layer of the organic electroluminescence ingredient which a laminating is carried out to this transparent electrode, and contains a hole transportation ingredient and an electronic transportation ingredient, A laminating is carried out to the luminous layer of this organic electroluminescence ingredient, and the back plate by the large electrode material of work functions, such as Au and aluminum, is formed. It is the organic EL device which formed [shape / of the shape of the shape of an island, and a hole vacancy, the shape of a stripe, and a mesh] almost equally partially the electron injection layer which becomes each laminating part with the luminous layer of the above-mentioned organic electroluminescence ingredient, a transparent electrode, and a back plate from metals, such as Li, Mg, etc. with a small work function, at the thickness of 1 - about 10A of numbers.

[0006] Moreover, it is the organic EL device which formed the hole block layer in the center by having

made the luminous layer of the above-mentioned organic electroluminescence ingredient into the laminated structure, and formed the luminous layer containing luminescent material which is respectively different on the both sides.

[0007] When the forward bias potential to which the organic EL device of this invention used the transparent electrode side the anode plate, and used the back plate side as cathode is impressed, while impregnation of a hole is performed from transparent electrodes, such as ITO with a high work function, to the luminous layer of an organic electroluminescence ingredient, in the back plate side which is cathode, impregnation of an electron is performed from electron injection layers, such as Li with a low work function. Moreover, when the reverse bias potential which made the transparent electrode side as cathode and made the back plate side the anode plate conversely is impressed, while impregnation of a hole is performed from back plates, such as Au with a high work function, to the luminous layer of an organic electroluminescence ingredient, in the transparent electrode side used as cathode, impregnation of an electron is performed from electron injection layers, such as Li with a low work function.

[0008] Moreover, by having formed the luminous layer containing luminescent material which is respectively different in the luminous layer of an induction ingredient, the potential of a transparent electrode and a back plate is with the time of forward bias and a reverse bias, impregnation of a hole is prevented by the central hole block layer to an adjacent layer, and different luminescence is enabled.

[0009]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is explained based on a drawing. Drawing 1 and drawing 2 show the first operation gestalt of the organic EL device of this invention, and the organic EL device of this operation gestalt is formed in the front face of the transparence substrates 10, such as glass, transparence resin, and a quartz, at the thickness whose transparent electrode 12 which consists of a transparent large metallic material of work functions, such as ITO, is about 1 micrometer so that it may illustrate. The luminous layer 14 by the organic electroluminescence ingredient is formed in the front face of a transparent electrode 12 at the thickness which is about hundreds of Å. And the back plate 16 which consists of a large metal of work functions, such as Au and aluminum, is formed in the front face of a luminous layer 14 at the thickness which is about 1000Å.

[0010] Between a transparent electrode 12 and a luminous layer 14 and between the back plate 16 and the luminous layer 14, the electron injection layer 20 of the shape of the shape of an island and a hole vacancy is respectively formed in the pole film which is about several angstroms equally at the predetermined spacing. The electron injection layer 20 is formed with the small metal of work functions, such as Li and Mg. Moreover, this electron injection layer 20 may be formed the shape of a stripe, and in the shape of a mesh, and that thickness can be suitably set up by the thickness of 1 - about 10Å of numbers that what is necessary is just the thickness in which electron injection is possible.

[0011] The luminous layer 14 of an organic electroluminescence ingredient consists of a charge of an admixture with which the hole transportation ingredient and the electronic transportation ingredient were mixed. As a hole transportation ingredient, there are a triphenylamine derivative (TPD), a hydrazone derivative, an arylamine derivative, etc. among the parent ingredients of a luminous layer 14. Moreover, as an electronic transportation ingredient, the aluminum chelate complex (Alq3) which is green luminescent material, the distyrylbiphenyl derivative (DPVBi) which is blue luminescent material, other OKISA diazole derivatives, a bis-CHIRIRU anthracene derivative, a benzooxazole thiophene derivative, perylenes, and thiazoles are used. As a dopant for furthermore carrying out a long wavelength luminescent color modulation, a dicyanomethylene derivative (DCM) and the Nile red (Nile Red) are added, a coumarin 540 (C540) etc. is suitably added as a green luminescent material, and the luminescent color of arbitration is obtained. Moreover, the mixing ratio of a hole transportation ingredient and an electronic transportation ingredient can be suitably changed in 10:90 thru/or 90:10.

[0012] The manufacture approach of the organic thin film EL element of this operation gestalt forms the transparent electrode 12 by ITO etc. on a substrate 10 first at the whole surface by the thin film coating technology in the vacuum of the usual vacuum deposition, flash plate vacuum evaporatio, and sputtering and others. Next, the electron injection layers 20, such as Li and Mg, are formed with

masking by the approach of the arbitration of the above-mentioned vacuum thin film coating technology the shape of the shape of an island, and a hole vacancy, the shape of a stripe, in the shape of a mesh, etc. Next, the luminous layer 14 of an organic electroluminescence ingredient is formed in the front face of a transparent electrode 12 and the electron injection layer 20 by the approach of the arbitration of the above-mentioned vacuum thin film coating technology. Furthermore, the electron injection layers 20, such as Li and Mg, are formed in the front face of the luminous layer 14 of an organic electroluminescence ingredient with masking like the above by the approach of the arbitration of the above-mentioned vacuum thin film coating technology the shape of the shape of an island, and a hole vacancy, the shape of a stripe, in the shape of a mesh, etc. And the back plate 16 by Au, aluminum, etc. is formed in the front face by the approach of the arbitration of the above-mentioned vacuum thin film coating technology.

[0013] Next, the protective layer which is not illustrated is suitably formed in the front face of a back plate 16. Protective layers are aluminum, Ag, and a thing that covers a back plate with resin etc. further.

[0014] A degree of vacuum is 6×10^{-6} Torr, and, in the case of an organic electroluminescence ingredient, forms vacuum evaporation conditions with the evaporation rate of 50 Å/sec here. Flash plate vacuum deposition drops 300-600 degrees C of organic electroluminescence ingredients beforehand mixed by the predetermined ratio in the source of vacuum evaporation preferably heated at 400-500 degrees C, and evaporates an organic electroluminescence ingredient at a stretch. Moreover, the organic electroluminescence ingredient is held into a container, the container is heated quickly, and it may be made to vapor-deposit at a stretch.

[0015] While impregnation of a hole 22 is performed from the transparent electrodes 12, such as ITO with a high work function, to the luminous layer 14 of an organic electroluminescence ingredient as shown in drawing 1 when the forward bias potential to which the organic EL device of this operation gestalt used the transparent electrode 12 side the anode plate, and used the back plate 16 side as cathode is impressed, in the back plate 16 side which is cathode, impregnation of an electron 24 is performed from the electron injection layers 20, such as low Li of a work function, and Mg. And EL luminescence arises by the hole transportation ingredient in a luminous layer 14, the electronic transportation ingredient, and other luminescent material. Moreover, while impregnation of a hole 22 is performed from the back plates 16, such as Au, aluminum, etc. with a high work function, to the luminous layer 14 of an organic electroluminescence ingredient as shown in drawing 2 when the reverse bias potential which made the transparent electrode 12 side as cathode, and made the back plate 16 side the anode plate is impressed conversely, in the transparent electrode 12 side used as cathode, impregnation of an electron 24 is performed from the electron injection layers 20, such as Li, Mg, etc. with a low work function.

[0016] According to the organic EL device of this operation gestalt, even if the polarities of the potential impressed to a transparent electrode 12 and a back plate 16 are any, light can be emitted effectively, and the organic EL device which does not ask the polarity of an electrode is made into ability.

[0017] Next, the second operation gestalt of the organic EL device of this invention is explained based on drawing 3. The same member as the above-mentioned operation gestalt attaches the same sign, and omits explanation here. The organic EL device of this operation gestalt is what made the luminous layer 14 the laminated structure, it forms the hole block layers 26, such as an OKISA diazole derivative (tBu-PBD) and a phenan ROTORORIN derivative (bathocuproine), in the center of a luminous layer 14, forms the mixolimnion 28 of TPD, Alq3, and DCM in the transparent electrode 12 side of the side of one of these, and forms the mixolimnion 29 of TPD, Alq3, and C540 in the back plate side of another side.

[0018] In this luminous layer 14, permeation is prevented for the hole 22 into which the back plate 16 was poured for the transparent electrode 12 from the transparent electrode 12 in the anode plate at the time of the forward bias of cathode by the interface of a mixolimnion 28 and the hole block layer 26, and orange luminescence is obtained by that DCM by the mixolimnion 28. Moreover, permeation is prevented for the hole 22 into which the back plate 16 was poured for the transparent electrode 12 from the back plate 16 in cathode at the time of the reverse bias of an anode plate by the interface of a

mixolimnion 29 and the hole block layer 26, and green luminescence is obtained from C540 of a mixolimnion 29.

[0019] According to the organic EL device of this operation gestalt, luminescence which is different with a single component is obtained, and the miniaturization of an organic EL device and the application as a color display are opened.

[0020] In addition, the thickness or the ingredient of that metal, a configuration, and the formation approach are not asked that the organic EL device of this invention forms the luminous layer of an organic electroluminescence ingredient in inter-electrode [of a work function / high], and should just form partially the thin electron injection layer of the small metal of a work function in that electrode surface.

[0021]

[Effect of the Invention] Without the organic EL device of this invention asking the polarity of a transparent electrode and a back plate, it is usable, the application of an organic EL device is extended, and handling will also become easy. Moreover, different luminescence by changing the polarity of an electrode can also be obtained, and two or more functions with one component can be demonstrated.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the typical sectional view showing the condition at the time of the forward bias of the EL element of the first operation gestalt of this invention.

[Drawing 2] It is the typical sectional view showing the condition at the time of the reverse bias of the EL element of the first operation gestalt of this invention.

[Drawing 3] It is the sectional view showing the EL element of the second operation gestalt of this invention.

[Description of Notations]

10 Substrate

12 Transparent Electrode

14 Luminous Layer

16 Back Plate

20 Electron Injection Layer

22 Hole

24 Electron

[Translation done.]